Ohio Agricultural Experiment Station

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SPRAYING TO KILL WEEDS—SOME USEFUL METHODS

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Wherever our ordinary culture methods fail us in the control of weeds, the matter of available spray solutions presents itself. This use of chemicals as sprays to destroy weeds has, heretofore, been better developed in the West, with its more limited labor supply and its restricted cropping systems. At present there seems to be little doubt that weed destroying sprays will find useful application in Ohio. Preliminary tests made last summer in cooperation with various farmers, and upon the Station farms, have given us preliminary information of considerable value.

The General Assembly has recently provided the funds for testing this matter under our Ohio conditions. This work is placed with the Department of Botany of the Ohio Experiment Station. It will be the endeavor to proceed with caution, and to cooperate with farmers, where possible, in various districts of the state which show conditions favorable to successful work.

WHAT WEED SPRAYS MUST ACCOMPLISH

What must be the line of operation or attack in the use of weed spraying chemicals? *These chemicals must destroy the weeds without injury to the crop grown.*

Most of our weeds are broad-leaved, or as we all know, plants with two seed-leaves. Our cereals and grasses are narrow-leaved plants which produce a single seed leaf. Upon the different reactions of these two classes of plants to the chemical sprays we must depend for our results—for injury to the weeds without harm to the crop. We find that *nearly all crops and weeds of the broad-leaved class of plants will be injured by these chemical sprays, and all weeds of the narrow-leaved class will escape injury by the sprays.* It follows

that crops of the clovers, alfalfa, soybeans, vetches and rape will be killed by such chemicals as destroy broad-leaved weeds, and that the sedges, quack-grass, crab-grass and wild onion or garlic will not be killed by spraying with such solutions as are not injurious to the grasses, cereal grains, etc. We may hope to destroy such weeds as mustards, dandelion, ox-eye daisy, white-top, thistles, carrot, parsnip, elders, poison ivy, ragweed, cockle-bur, papaw bushes and horse-nettle, as well as practically all other broad-leaved weeds, by use of these sprays. At the same time, these sprays will leave blue-grass, timothy, red-top and other grasses, including the growing cereal grains, such as wheat, oats, rye, etc., without injury if properly adapted in strength and time of application.

Briefly summed up, *weed sprays, when properly adapted, should be available for the destruction of the larger portion of our pasture and grain field infesting weeds, when the methods are rightly and economically developed.* It would certainly be a travesty on our methods of culture to expect to substitute weed sprays for culture in the growing crop, such as in corn fields and the like.

WHAT SPRAYS TO USE

The most promising spray solutions tested are as follows:

Common salt solution, containing 3 pounds of salt to the gallon of water, applied at the rate of 50 to 75 gallons per acre sprayed.

Iron sulfate (copperas) solution, containing 1 3-4 to 2 pounds of iron sulfate to the gallon of water (100 pounds iron sulfate to 52 gallons of water). Use at the rate of 50 to 75 gallons per acre.

Calcium chlorid solution of same strength as salt and used at the same rate.

Sodium arsenite solution made from 1 1-2 pound sodium arsenite in 50 gallons.

Copper sulfate (blue vitriol) solution, containing 8 to 10 pounds of blue vitriol to 50 gallons of water; applied at the rate of 40 to 50 gallons per acre.

Salt has thus far proved the best spray tested in Ohio for Canada thistle, poison ivy, yarrow and horse nettle. In the Northwest sodium arsenite is given first rank. Salt is probably the most effective to destroy dandelion and some other weeds. Iron sulfate is very satisfactory to kill mustard weeds, ragweed, white-top, yarrow, and we believe a great many other broad-leaved weeds. Neither the salt nor the iron sulfate is regarded as offering any risk of application to pastures in which stock is running. Sodium arsenite is a very active poison and rather dangerous for that reason. Calcium chlorid has done very well where tested, but appears to be slightly inferior to salt. Copper sulfate solutions may be used in grain fields for mustards especially, but owing to the poisonous nature of the copper sulfate, it has a very narrow range of application.

THE COST OF SPRAY CHEMICALS

The spray chemicals mentioned are not expensive. The iron sulfate in sugar or granular form is a by-product in wire fence manufacture, and is offered at reasonable prices by the American Steel & Wire Co., of Chicago. In bags, this granular sulfate is quoted at less than 90 cents per 100 pounds, f. o. b. at principal Ohio points.

Common salt is a cheap chemical, being sold at about $1.10 to $1.25 per barrel of 280 to 300 pounds.

Calcium chlorid is obtainable at points in the Pomeroy salt district at a price of about $9.00 per ton, less than car lots. It is packed in drums of 600 to 700 pounds each.

Copper sulfate is sold by almost all druggists, and costs from 5 to 6 cents per pound in barrels of 480 pounds each, or more at retail.

Sodium arsenite is rather an expensive chemical, upon which we have no quotations. (See Spray Calendar, Formula No. 22.)

HOW TO APPLY WEED SPRAYS

The chemical solutions used as sprays to kill weeds should be applied, as all other sprays, by means of suitable spray nozzles which deposit the solution as a fine mist upon the surface of the leaves of the plant. One can use almost any good spray pump which will give good pressure, and direct the spray nozzles after the manner used in orchards and vineyards, or the traction potato sprayers can be so adjusted as to spray the whole area, instead of the row spaces only, thus applying the spray more satisfactorily.

More recently manufacturers have developed special forms of spray machinery in the West in which the force pump is run by traction, as in potato sprayers. A long rod or "boom" is attached to the rear of the sprayer, with nozzles at intervals of 8 to 12 inches; the outfit being thus driven over the grain field or pasture, secures the proper application of the spray. Certain of the western weed sprayer manufacturers have developed a "boom" with nozzles, which may be attached to any spray outfit. It is believed that these "booms," and some of the special sprayers, which, of course, are fitted with different sized tanks, will be found adapted to use in the Ohio tests. The following are some of the manufacturers of special weed spray outfits:

American Machinery Co., Minneapolis, Minn.
The Wallace Machinery Co., Champaign, Ill.
The Binks Spraying Machine Co., Fulton St., Chicago, Ill.
E. C. Brown & Co., Rochester, N. Y.

The Binks Spraying Machine Co., Fulton Street, Chicago, manufacture a special "boom" adapted to be connected with any sprayer.

WHEN TO APPLY WEED SPRAYS

In practice, the time of applying sprays needs to be adjusted to the condition of the growing crop, and the relative development of the weeds to be killed. It seems probable that very early spraying will be less effective than spraying after the weeds have developed a fair supply of leaves. The first spraying should be made not later than the beginning of bloom. Repeated applications need to be made as often as a new supply of leaves is developed, provided the condition of the host crop permits this. In grain fields, the best results will be obtained on practically all weeds, when only a single spraying is to be made, to apply the spray just as the crop is ready to occupy the land. With mustards, this will find some already in bloom. With ragweed, it is best to spray before the stems of the plants become hardened. With other weeds, of which these two are the type, as well as with these, it is often profitable to make an extra earlier spraying than that designated. For perennial sow thistle, wild lettuce and orange hawkweed, the spraying in grain fields should precede the blooming of the plants, and in cases of bad infestation with perennial sow thistle or the golden hawkweed, two sprayings should be made before the grain occupies the land. It is not clear just what can be done in the handling of bindweeds in in grain fields, but similar principles will apply. For spraying in timothy or other grass meadows to kill white-top, yarrow, self-heal, ox-eye daisy and a number of meadow weeds, the principle is similar to that stated for grain fields, namely, to spray thoroughly just before the grass begins heading out. This will be during late May and early June for Ohio.

In spraying pastures to check weeds, the maximum returns will usually come from a beginning application in late June or early July before many weeds are coming bloom. After the initial application, the spraying should be repeated as often as there is development of new foliage to a marked degree.

In general, better results are obtained from applications made in cloudy weather, although any weather, except that followed by rain, is satisfactory.

SPRAYING FOR CERTAIN WEEDS

The spray applications need to be adapted, more or less, both as to kind and time of application, to the particular weeds present. This was shown in experiments to destroy poison-ivy on fences at Wooster. We had very little effect from spraying with iron sulfate, very good results from spraying with the common salt solution, and the results from calcium chlorid were slightly inferior to those from

common salt. Where the common salt was used, and two applications were made some three to five weeks apart, the poison-ivy vines were dead the following spring. Similar experiments were carried on at Carpenter, where we found that iron sulfate would have no effect upon the leaves of horse-nettle, while salt solutions were very satisfactory, destroying the crop of leaves, and forcing the plants to put out new leaves. Under these conditions we expect, by two or three successful sprayings, to kill a large share of the weeds in a single season—the more resistant plants being given a repetition of the treatment the next season.

In the case of mustard weeds, very good results have been obtained by the iron sulfate solution, and there is little difference in the results obtained upon timothy meadow weeds in general, such as white-top, yarrow, self-heal and several others, as between the applications of iron sulfate and those of common salt. On the other hand, Canada thistle is not destroyed satisfactorily by iron sulfate solution. It is killed down quite well by the common salt, and our western friends report even better results by the use of sodium arsenite.

Upon ox-eye daisy we need to have further tests, as well as upon a large number of different plants.

For dandelions the matter is an open question whether iron sulfate solution, or the common salt solution is the better for the purpose. We have made partial tests through two seasons at Wooster, and find that the first spraying should be made before any of the plants come into bloom, and that two or three later sprayings will probably be found profitable during the season.

WE HAVE YET TO LEARN ABOUT SPRAYS FOR SEVERAL WEEDS

As previously stated, in 1909 we learned what to use and how to spray, to keep down poison-ivy and horse-nettle, as well as white-top and yarrow. We have yet to learn the best way of handling ox-eye daisy, wild parsnip, iron-weed, osier willows, milkweed, velvet-leaf, bladder ketmia, bindweed and a large number of other common weeds.

The object of the work upon which we are now engaged is to determine just how to apply the sprays, and what sprays to use for the eradication of these weeds under our Ohio conditions. Of course, we realize that what has been done in other climates, upon the same weeds and plants, has more or less suggestion in it for Ohio. Nevertheless, our different climatic conditions may give very different results from those obtained in the Northwest.

IS WEED SPRAYING A PROFITABLE BUSINESS FOR OHIO?

As before intimated, it is yet to be proved whether weed spraying is a profitable business proposition under our Ohio conditions. We are entering upon this work in the spirit of inquiry. The small amount of work done in 1909 indicates some very desirable results within our reach with respect to freeing our Station farm and Test farms from such persistent growths as poison-ivy, papaw and horse-nettle. The Station hopes to investigate this matter of weed spraying in the spirit stated, and to be able to give, the results obtained, in the course of time, for the benefit of the public.

Whoever has no troublesome weeds will have no use for weed spraying. Whoever has troublesome weeds through slovenly methods of culture in cultivated crops, such as corn and potatoes, is not likely to be greatly assisted by weed spraying; but grass meadow lands, pastures, roadsides along our highways, along railroads and electric lines, and such grounds as parks and lawns, are open and offer a very wide field for determining the usefulness and profit of chemical sprays to destroy the weeds in them.

OHIO AGRICULTURAL EXPERIMENT STATION

COST SHEET FOR WEED SPRAYING—YEAR 191..

Name of cooperator.....Address.....

Designation of experiment, A, B, C, D, E, F, G.

Location.....Field—Crop.....

Date of seeding..... Weeds.....

Estimated prevalence of weeds at beginning, No: per sq. yd.....

Previous crop.....Yield in bushels.....Proportion of weeds.....

TIME COST AND SOLUTIONS USED

	First Spraying	Second Spraying	Third Spraying	Fourth Spraying	Fifth Spraying	Total
Date.....						
Solution used.....						
Number gallons...						
Area in acres.....						
Sq. rods....						
Spraying:— Time, 1 horse						
2 horses						
Time man, hrs....						
Mak' solution hrs.						
.....						
.....						

Team to be charged at.....cents per hour. Man to be charged at.....cents per hour.

Total cost dollars per acre.....

EFFECTS OF SPRAYING

Sprayed area, weeds per sq. yd., when harvested.....

Proportion that ripened seed.....

Unsprayed check, weeds per sq. yd., when crop harvested.....

Proportion that ripened seed.....

Yield crop sprayed.....bu. Yield crop unsprayed.....bu.

Gain from spraying.....bu. at.....

Charge cost items: Hours team.....Hours man.....Profit.....

Comments:.....

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